SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

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THE YORK MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE meeting of the British Association at York from the first to the eighth of August has a peculiar historical interest in that this interesting and beautiful town was the seat of the foundation of the association seventy-five years go and was the meeting place twenty-five years ago. This time the York Philosophical Society, under whose auspices the first meeting of the association was planned in 1831, was again the host.

The many points of interest in the surrounding country and in the city itself, the numerous halls and meeting places, the beautiful garden and interesting collection of the museum and the great assembly hall, all combine to make York a most attractive and suitable place for this great gathering of the best in English science. The delightful hospitality of the people of York added much to the pleasure of this particular meeting. Perhaps the most attractive of the social gatherings were garden parties given by the Archbishop of York and Mrs. Maclagan at the picturesque and historical palace at Bishopthorpe; by the Sheriff of York and Mrs. Bentley at their beautiful home at Fulford Grange, and by the Messrs. Rowntree and Company at the celebrated cocoa works, while the museum and grounds of St. Mary's Abbey were lighted up by thousands of candles on two occasions for conversazioni. At the great cathedral an organ recital and a special

service with sermon by the Bishop of Ripon, were most impressive.

In view of the anniversary nature of this meeting, it is not out of place here to repeat the aims of the British Association which were set forth seventy-five years ago by William Vernon Harcourt as follows:

> To give a stronger impulse and more systematic direction to scientific enquiry, to obtain a greater degree of national attention to the objects of science, and a removal of those disadvantages which impede its progress, and to promote the intercourse of the cultivators of science with one another and with foreign philosophers. Therefore it is that I propose to you to found an association, including all the scientific strength of Great Britain, which shall employ a short period of every year in pointing out the lines of direction in which the researchers of science should move, in indicating the particulars which most immediately demand investigation, in stating problems to be solved and data to be fixed, in assigning to every class of mind a definite task, and suggesting to its members that there is here a shore of which the surroundings should be more accurately taken, and there a line of coast along which a voyage of discovery should be made.

E. Ray Lankester, in his presidential address before a brilliant gathering of 1,800 members and guests, reviewed some of the more important advances in science which had been made during the quarter century which has elapsed since the last meeting in York, and he characterized these advances as showing a 'continuity and healthy evolution in the realm of science' rather than any revolution or inconsistency in the previous course of human thought. His address, which was somewhat disjointed because of many cuts, was based largely upon contributions from certain leaders in different branches of science, and much was lost of that spontaneity which comes from personal opinion, although made up perhaps by the thoroughness of the presentation. Particular attention was given to radium on the side of the physical sciences and to human disease and to Metchnikoff's phagocytic theory of immunity on the side of the natural sciences. Curiously enough, one of the most widely-followed branches of modern research, experimental zoology, was not even mentioned.

In this brief outline only the general trend of the scientific work of the several sections can be given. Before Section A (Mathematics and Physical Science) President Griffiths gave a review of the progress of physical science in the last twenty-five years, emphasizing the need for more accurate measurements of the elements and for improved methods in scientific education to meet the modern requirements of the vast stores of accumulated knowledge.

Interesting discussions upon the evolution of the elements, opened by Mr. Soddy, and upon the notation and use of vectors, opened by Professor Henrici, were held in the departments of general physics and pure mathematics, respectively, while at a combined meeting of the two sub-sections a more generally interesting discussion was opened by the Honorable R. J. Strutt on radioactivity and the internal structure of the earth, in which it was concluded that no radium exists in the center of the earth and can be traced to a depth of only 45 miles, which is enough to account for the heat of the earth. The discussion was carried on by Professor J. Milne, Sir William Crookes, Sir William Ramsay, Mr. Soddy, Professor J. W. Gregory, Professor Lamb, Sir George Darwin and others. Other interesting work of the section concerned Professor Milne's seismological investigations, in which the interesting theory was propounded that a valley opens and shuts, opens by day and closes by night; and still another by Professor J. Swinburne on the nature of radiation from incandescent mantles.

In Section B (Chemistry) the work was confined chiefly to economic products, to

economic problems of commerce and to problems of diet.

In Section C (Geology) the president, Mr. G. W. Lamplugh, gave an address dealing with glacial problems of England and with special attention to local Yorkshire drifts. In the sectional meetings there was a preponderance of papers dealing with local geological problems; one of more general interest by Professor J. Milne on Certain Earthquake Relationships attracted wide attention, while a general discussion on the origin of the Trias was opened by Professor T. G. Bonney and Dr. J. Lomas.

In Section D (Zoology) Mr. J. Lister took as his subject for the presidential address the Life History of the Foraminifera, in which the old question of the significance of dimorphism of the foraminifera was clearly and conclusively answered. There were two discussions before this section and one before a joint session of Sections D and K (Botany). The first, on the Protozoan Life Cycle, was opened by G. N. Calkins and discussed by Mr. Lister, Professor Marcus Hartog and Professor Hickson. The second was opened by J. E. S. Moore on the Tanganyika problem and was discussed by Professor Lankester, Dr. Coningham, Professor Pelseneer, Mr. Boulenger, Mr. Stanley Gardiner, Professor J. W. Gregory and Mr. F. S. Harmer, the general sentiment being against Dr. Moore's theory that the characteristic fauna of this African lake indicates the early connection of this lake with the sea. The third discussion, held in joint session with K, was largely attended; the subject, The Nature of Fertilization, was opened by Mr. Vernon H. Blackman with a general historical treatment of the origin and significance of maturation chromosomes, and by G. N. Calkins and Mr. L. Doncaster, the former on the Life Cycle, with special reference to Maturation, Fertilization and Parthenogenesis in Protozoa, the latter on the Maturation of Parthenogenetic Eggs. The interesting discussion following these papers was by Professor Havet, Dr. Rosenberg and Professors Johannsen, Hickson, Poulton, Hartog and Wager.

In Section E (Geography) the presidential address, by Sir George Goldie, dealt with the history of geography during the last twenty-five years and clearly showed that from pioneer work the subject of geography has developed into a science recognized in all grades of education, thus taking a larger place in the life of the nation than ever before. Interesting papers were read by Major John M. Beacom of the American Embassy, London, on Irrigation and National Prosperity in the United States, and by Mr. Clement Reid on Coast Erosion, which was followed by an animated discussion by Mr. Stanley Gardiner and Mr. John Spiller.

In Section F (Economic Science and Statistics) Professor A. L. Bowley dealt with the inadequacy of present methods in collecting statistics, with the need of better training for statisticians, with mathematical statistics, and with the problem of the unemployed. In the program four general divisions of the subject were made, viz., Transportation, Industries, Labor Questions and Miscellanies. British and American methods of transportation were compared by R. L. Wedgewood and P. Burtt, of the Northeastern Railroad, and by Professor E. R. Johnson, with particular reference to special problems of traffic-handling, gauge limits and the like. The woolen industries were considered by Professor Clapham, Local Yorkshire Industries by Mr. J. Backhouse and Mr. Turnbull, while a discussion on the question of the Unemployed was well attended. The most generally interesting of the miscellaneous subjects were those of Mr. Lees

Smith on the Minimum Wage Policy; by Professor Edgeworth on Distribution; and by Dr. Cannon on Public Finance.

Dr. Ewing's presidential address before Section G (Engineering) dealt with the molecular structure of metals, with especial reference to their reactions under strains and to the conception that they are aggregates of crystals. He considered the matter of fatigue in metals, their recovery by rest, and the manner in which they break down under repeated alterations of stress. A long and varied sectional program of some twenty-three papers followed, many of special or local interest, some of more general value, such as Modern Armor and its Attack, by Major W. E. Edwards, and some Recent Developments in the Steam Turbine, by Mr. Gerald Stoney. Several excursions to neighboring engineering plants were made by the members of this section.

One of the most popular sections in point of attendance and of general interest was H (Anthropology). The general bearing of the president's address by Professor Sidney Hartland was the Origin and Early Relation of Magic and Religion. Many of the sectional papers dealt in a popular way with travels and peoples, customs and traditions. Amongst these one of the most interesting was by Dr. A. C. Haddon on The Ethnology of South Africa. Similar papers on special topics were numerous.

In Section I (Physiology) Professor Gotch criticized the view of vitalism in modern biology and attempted to show that physiological processes might all be interpreted in complex physical and chemical terms. The conception was advanced that the nervous system acts as a purely automatic mechanism based upon physico-chemical changes. One of the most interesting and most important discussions of the meeting was opened by Professor T. D. Acland on the Physiological Value of Rest. It was discussed, together with a paper on the neuron theory given by Dr. Bevan Lewis, by Professors Sherrington and Myers, and Drs. McDougal and Rivers. It was in this section, too, that perhaps the most acrimonious discussion took place over a paper by Dr. Hime on The Insufficiency of Preventive Measures against Infectious Disease. His view that isolation is unnecessary in infectious diseases was especially provocative and met with some sharp rejoinders.

In Section K (Botany) President F. W. Oliver gave a somewhat technical address on The Seed—A Chapter in Evolution. The papers at the sectional meetings were all of a technical nature, one discussion being held, as already noted, in conjunction with Section D.

Finally, in Section L (Education) Professor M. E. Sadler pointed out in his presidential address the fact that education is becoming more and more a national problem. He showed that the interdependence of the various parts of education is becoming more fully realized and that the different branches are tending towards greater unity. It was also shown that more definite needs were apparent in regard to individual instruction, especially as concerns the obligations to the state. As usual with this section, the program was drawn up with respect to a central topic. This year the topic selected was The Balance of Subjects in the Curricula of Schools of All Grades. The discussions on Primary Grade Teaching, on Nature Study, on Leisure Pursuits, etc., were animated and suggestive. 'Health in Schools' was presented by Professor Sherrington; Physical Training, Training for Work People, School Training for Home Duties of Women, etc., were all discussed. The

section held a joint meeting with Section A, in which the teaching of mechanics by experiment was discussed.

As usual at these association meetings there were some evening lectures on more general topics. A most interesting lecture on Volcanoes was given by Mr. Tempest Anderson, of York; another was on the manufacture of light, by Professor Sylvanus Thompson, and another on The Electrical Signs of Life and their Abolition by Chloroform, by Dr. A. W. Waller.

In 1907 the association meeting will be held in Leicester; in 1908, in Dublin; and in 1909 in Winnipeg, Canada.

GARY N. CALKINS.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. SECTION F—ZOOLOGY.

SECTION F at the Ithaca meeting held joint sessions for the reading of papers with the American Microscopical Society, June 29 and 30. The following papers were read under the auspices of Section F.

Chromosome Relations in the Spermatocytes of Oniscus: M. LOUISE NICHOLS, University of Pennsylvania.

In the equatorial plate of the first maturation division, chromosomes differing from each other in shape may be discovered. They are of three kinds: First, straight or dumb-bell-shaped, in which the halves of the bivalent chromosome lie end to end; second, curved or crescent-shaped, in which the halves lie end to end but with the extremities curved toward each other; third, a form in which the halves lie side by side. In each type a split may be seen running the length of the individual chromosome and the first division is reductional. In the prophases of the first maturation division chromosomes of the first and second types are present as straight or curved rods; the third type is represented frequently by rings, complete or nearly so, occasionally by V-shaped structures. The reduced number of chromosomes, as far as could be determined, is sixteen. Of this number, two have the ring form in the prophase, two the crescent form, while the remainder are straight or dumb-bell shaped. The chromosomes vary somewhat in size, but the differences are not strikingly great. The largest have the ring form, the smallest are straight. A tendency to localization in the nucleus is observable. The ring forms usually lie on opposite sides of the nucleus, separated by a crescent. Similarly the crescent forms lie on opposite sides with a ring between.

Notes on the Poison Organs in Fishes: H. D. REED, Cornell University.

Axillary poison glands are found in all species of *Noturus* and *Schilbeodes.* In *S. gyrinus* and *S. nocturnus* poison glands are found enveloping the pectoral and dorsal spines. Wherever found these glands are invaginations of the skin, in which respect, as well as in structure, they are identical with the poison organs of the weever fishes.

Exhibition of Bird Drawings: L. A. FUERTES, Ithaca, N. Y.

Exhibition of and Remarks upon Certain Rare or Unique Specimens in the Cornell University Museum of Neurology and Vertebrate Zoology: BURT G. WILDER, Cornell University.

Among the specimens are the smallest recorded manatee fetus; a human embryo about 4 mm. long attached to the vitellus; an embryo shark with undivided cerebrum; the brain of the anguin, or frilled shark, presenting the indifferent relation of the cerebral and olfactory portions more nearly than in any other known vertebrate; the brain of *Ceratodus,* presenting the characteristic dipnoan ventral cerebral extensions; the brains of *Tarsius, Cheiromys*

and all the anthropoid apes; the brain of the manatee; the brain of a sheep with defective callosum and fornix, and that of a cat lacking these parts altogether; that of a child born at term with the cerebral hemispheres in the fetal condition of large cavities and thin parietes; an adult human brain with an extra precommissure; the brains of two philosophers and mathematicians differing markedly, and that of a mulatto resembling one of the former; the brain of a dentist presenting two self-inflicted pistol-ball wounds; the separable dental laminæ of a young elephant; mastodon teeth and bones from near Ithaca; the brains of some rare Japanese sharks.

Sex Differentiation in Dinophilus: Edwin G. Conklin, University of Pennsylvania, Philadelphia.

Korschelt (1882) discovered that *Dinophilus apatris* lays two kinds of eggs, the one three times the diameter of the other; and he further determined the important fact that the small eggs invariably develop into males and the large ones into females. He did not, however, study the oogenesis of these two kinds of eggs. The occurrence some years ago of a related species of *Dinophilus* in the marine aquaria at the University of Pennsylvania gave me an opportunity to study this problem.

The earliest stages in the developing ovary of *Dinophilus* which I have examined shows only one kind of primitive egg cells or oogonia. These cells are very small and details of their structure are not readily made out, but all are approximately of the same size. The size and structure of these cells and of their nuclei are apparently the same in all cases. I have repeatedly seen the last oogonial division, but the chromosomes are so small and numerous (about 20) that it has not been possible to distinguish any constant difference either in the number or in the shapes of these chromosomes.

After the oogonia have entered upon the growth period and have reached about twice their original diameter they begin to fuse together and in this process at least twenty-five or thirty fuse to form the female eggs, while a much smaller number fuse to form the male eggs, a fact recently reported by R. Hertwig (1905). In the fusion, the cell boundaries first disappear and then some time later the nuclear membranes dissolve and the nuclear contents are scattered in the cell, where they slowly dissolve. Only one nucleus remains in the syncytium; this is in most cases centrally placed, but I have been unable to determine whether its survival depends upon its position or upon some intrinsic difference.

In the fully formed ovarian eggs the nucleus of the small eggs is relatively larger than that of the large ones, as R. Hertwig (1905) has stated, the relative diameter of the nucleus to the entire cell being about 1:4 in the case of the male eggs and about 1:6 in the case of the female eggs. In this fact Hertwig thinks we have the cause of sex determination. It is doubtful whether this can be accepted as a general explanation, and even in the case of *Dinophilus* it is not certain that it is the true explanation. The relatively greater size of the nucleus in the male eggs is probably due to the smaller number of cells which fuse to form the cell body, and this may result from the relative isolation of the male eggs as compared with the crowding of the female eggs.

In the first maturation division the chromosomes, though small, may be counted, and it is found that there are ten in both male and female eggs. No differences in the size of individual chromosomes can be detected in the two kinds of eggs.

The manner in which the primary oocytes

fuse together to give rise to the male or female eggs suggests that the position of the eggs in the ovary and their relative isolation or crowding may here be the sex-determining factor.

Glycogen in the Nervous Tissue of Embryo Mammals, with Demonstration: SIMON H. GAGE, Cornell University.

From the first discovery of glycogen in animal tissues by Claude Bernard in the fifties until the present time, all investigators assert that glycogen is not present in nervous tissue at any stage of development or during any state of activity. In the summer of 1904 while at the Bermuda Biological Station *Amphioxus* material was fixed in absolute alcohol for the determination of glycogen. Abundant glycogen was found in the large nerve cells of the central nervous system in both *Amphioxus* and *Asymmetron*. From this discovery it was believed that glycogen would probably be found in the nervous tissues of mammals if they were taken at the right time. A series of pig embryos from 7 to 70 mm. were sectioned and plentiful glycogen was found in the cells of the dorsal ganglia in embryos from 7 to 20 mm. In the 20 mm. embryo glycogen was also present in the developing nerve trunks, and in older embryos it nearly or quite disappeared from the ganglion cells but became exceedingly abundant in the nerve trunks. These facts point to the conclusion that at some period in the growth of nervous tissue glycogen plays as important a part as in the other tissues of the body.

The Notochord of the Head in Human Embryos of the Third to the Twelfth Week, and Comparisons with Other Vertebrates: SUSANNA PHELPS GAGE, Ithaca, N. Y.

In the Cornell collection are many sagittal series which are especially favorable for the study of a mesal organ like the notochord. In a human specimen of sixty days the relations of the notochord to the cartilaginous base of the skull and the epithelium of the mouth are clear. On emerging from the axis, it forms a knotted protuberance dorsal of the base of the skull, passes diagonally through it to a pocket from the roof of the mouth, thence cephalad to come in contact with two other mouth pockets, thence diagonally dorsal through the base of the skull, again forming a knot and turning sharply ventrad, ending near the hypophysis but within the cartilage.

The same relations exist in a specimen of forty-eight days in which the base of the skull is not as far from the roof of the mouth and the excursion of the notochord is not so far ventrad.

At thirty-six days the condensed mesoderm foreshadows the skull, and the same general relations occur, the ventral excursion of the notochord being very limited and touching the straight roof of the mouth in three or four loops.

At twenty-eight and twenty-one days the notochord lies directly in contact with the epithelium of the roof of the mouth, thus showing the beginning of the history. Transections verify the above observations.

The comparative study of pig, sheep, calf, mouse, cat, chick, amblystoma, frog, shark and lamprey shows that the notochord after the earliest stages is usually completely separated from the roof of the mouth, being included in the more condensed tissue forming the skull and taking a straight course. In the pig, however, about twenty per cent. were similar to man, being in contact with mouth pockets.

In the calf, contrary to the observation of Froriep, the specimen examined showed the usual straight form.

The cephalic tip of the notochord in the

above mentioned examples varies in relation, being in contact with: (*a*) the hypophysis (ingrowth of skin); (*b*) Sessel's pocket (outgrowth of enteron); or (*c*) the first mesodermic head cavity (derivative from enteron). The last condition, found in shark, may be the typical one.

Importations of the Gipsy Moth and Brown-tail Moth Parasites from Europe: L. O. Howard, U. S. Department of Agriculture.

In the late spring of 1905 the state of Massachusetts appropriated ten thousand dollars a year, for three years, to be expended in an effort to import into the United States the European parasites of the two destructive insects mentioned in the title. The larger part of this appropriation, together with a small appropriation of twenty-five hundred dollars, made by the general government, was used and is being used in this attempt, the whole European end of the effort having been placed under the control of the speaker.

In June, 1905, he visited Europe, landing at Naples on the fifteenth of that month. At the time, the south European brown-tail moths had all issued, and the gipsy moth was in the full-grown caterpillar stage. Arrangements were made with experts in Italy, in Austria, in Hungary, in South Germany, Switzerland and France to send to Boston full-grown larvæ and pupæ of the gipsy moth; and full instructions were given as to methods of shipment. During the following summer months very many specimens were received in Boston and were cared for in a temporary laboratory at Malden and a number of different species of parasites issued, the most promising ones being tachina flies. These over-wintered successfully in Massachusetts, and a certain proportion of flies issued from the over-wintering puparia the present spring.

In April, 1906, the same journey was practically repeated, the speaker visiting first France, then Italy, then Austria and Hungary, and afterwards Germany and Switzerland, and arrangements were made, at an earlier period in the season, so that much larger quantities of both species will be secured. Shipments from many points in Europe are already being received and many parasites are being bred from European specimens of both species.

The most interesting feature of the effort so far has come through the wholesale introduction of the over-wintering nests of the brown-tail moth. On the strength of an unpublished observation of Jablonowski, of Budapest, mentioned to the speaker in July, 1905, no less than one hundred and eighty-five thousand nests were imported into Massachusetts from forty different localities in Europe, ranging from Rennes on the northwest to Budapest on the southeast. From these nests were bred the present spring and early summer many thousands of specimens of parasites of different groups; these have been colonized in the open and in out-door cages constructed of wire gauze and placed over good-sized trees thoroughly infested with both gipsy moth and brown-tail moth larvas.

The interesting feature of the experiment is the large scale upon which it has been conducted. Earlier attempts to introduce and acclimatize beneficial species from one part of the world into another have been done on a small scale; but comparatively few have been imported at any one time. In this instance the experiment was so perfectly safe and the country into which the forms were introduced was so extensively ravished by the insects that the introduction of additional pests of the same species could possibly do no harm; whereas, by such wholesale introduction, vastly greater numbers of the parasites would be

secured, thus promising earlier relief than by the other method.

On the Connections of the Funicular Nuclei of the Brains of Fishes: C. JUDSON HERRICK, Denison University.

In those teleosts which possess elaborately developed taste bud systems in the outer skin, we find that the entire taste bud system of nerves, including nerves from sense organs in the mouth and pharynx and also from similar organs in the outer skin, is very intimately connected with the viscero-motor nervous apparatus, as was to have been expected. But the terminal nuclei of the nerves from taste buds in the outer skin, which unquestionably belong morphologically to the visceral sensory system, have extensive additional sensory connections with distant motor centers of the somatic type. These long reflex gustatory paths are of relatively recent phylogenetic origin and in some teleosts are very elaborately developed. The connections in the mid-brain of the ascending secondary gustatory path I have described in a previous communication. In this paper I have analyzed the descending secondary gustatory path and found that in its further course and connections in the funicular nucleus region it has all of the functional characteristics of a somatic reflex arc—from cutaneous organs of taste to somatic muscles. This is a point of considerable theoretical interest as a concrete illustration of the way in which the most rigid morphological lines may be crossed by the exigencies of functional adaptation.

The Hackled Band in the Webs of Certain Spiders: J. H. COMSTOCK, Cornell University.

It is well known that those spiders which possess a cribellum and a calamistrum spin two kinds of silk: one, a simple smooth thread of the ordinary type, and another that presents a curled appearance. Photomicrographs of the silk of representatives of three families of cribellate spiders were presented. In each the characteristic silk consists of a ribbon-like structure which, on account of the manner in which it is made, may be termed the hackled band. In each case the hackled band consists of two elements: a series of longitudinal threads, which may be termed the warp, and a sheet of viscid silk supported by the warp, which may be termed the woof. In the hackled band of *Uloborus* and *Hyptiotes* the warp consists of two straight threads, and the woof of an exceedingly regular series of overlapping lobes. In the hackled band of *Amaurobius* the warp consists of four threads. Two of these lie in the central portion of the band; they are straight and parallel. The other threads extend, one along the middle of each lateral half of the band, and are curled. These four threads support a sheet of viscid silk, the woof. The woof has a wavy outline, but does not consist of a regular series of lobes, as in the Uloboridæ. In the hackled band of *Filistata* there are four kinds of silk. First, a double supporting line; second, the primary looped threads; third, the secondary looped threads; fourth, the woof of viscid silk.

The Divided Eyes of Blepharocera tenuipes Walker: WM. A. RILEY, Cornell University.

The physiology of the divided eyes of *Blepharocera tenuipes* has been discussed by Kellogg, but aside from incidental mention nothing concerning their morphology has been published. The facets of the dorsal eye average forty microns in diameter, those of the lateral eye twenty-four microns. Both eyes are clothed with hairs, usually one at each facet angle, rarely two. In section the dorsal ommatidia are about three times the length of the lateral. Un-

like other nematocerous diptera studied, the eyes—both dorsal and lateral—are of the pseudocone type. Among the numerous slender secondary pigment cells may occasionally be found a much-reduced trichogen cell. There is no special corneal hypodermis such as is present in Crustacea and Collembola, but it is represented by the primary pigment cells. The presence of abundant pigment between the ommatidia and the position of the visual rods preclude the formation of superimposed images. There is no evidence of pigment migration dependent upon intensity of light. In the youngest pupæ studied the eye is represented by a one-layered hypodermis in which groups of enlarged sensory cells are separated by more slender cells. There is no invagination, but the groups of sensory cells become bud-like, pushing the pseudocone cells and the primary pigment cells to their distal surfaces while the secondary pigment cells become crowded into wedge-shaped masses at either end. In course of further growth the elements elongate greatly. The lateral eye differentiates more rapidly than the dorsal, a condition to be explained by the late phylogenetic appearance of the dorsal eye.

The Nervous System and Nephridia of Dinophilus: J. A. Nelson, Cornell University.

The nervous system exhibits an embryonic condition, consisting of a brain in close contact with the hypodermis, and a pair of lateral nerve cords, connected by transverse commissures arranged metamerically. Ganglion cells, lying within the hypodermis, accompany the lateral nerve cords, and are arranged to form five pairs of ganglia. A preoral commissure connects the circumœsophageal commissures. The nephridia number five pairs, and are arranged metamerically. Those of the posterior four pairs are simple, and similar to those of annelid larvæ, terminating blindly at their inner ends. Those of the first pair are much more complex, each exhibiting two curious canalar plexuses. The whole anatomy indicates close relationship to the annelids.

Early Stages in the Development of the Salivary Glands in Sheep and Pig Embryos: Wm. C. Thro, Cornell University.

Glands in Sheep Embryos.—In an embryo 17.5 mm. long all the glands are present. The submaxillary is the most advanced, since a few side buds project from the body of the gland. The sublingual consists of a short ridge-like projection of the epithelium lining the mouth-cavity. In a 20 mm. embryo the sublingual consists of a solid cord of cells attached by its cephalic end to the epithelium lining the mouth-cavity and running caudad a short distance beneath the epithelium. In a 26 mm. embryo Wharton's duct possesses a lumen. In a 43 mm. embryo the sublingual and parotid have lumina. In an embryo 44.5 mm. long the ducts of the submaxillary and sublingual run side by side and open beneath the tip of the tongue, cephalad of the frenum.

Glands in Pig Embryos.—In an embryo 15 mm. long, head-breech measurement, the very earliest stages of the parotid and retrolingual glands are found, while the submaxillary is represented by a well-developed bud with enlarged extremity.

The Development and Relations of the Columella in the Amphibia: B. F. Kingsbury, Cornell University.

The Inheritance of Characteristics in Poultry: C. B. Davenport, Carnegie Institution of Washington.

In how far are the characteristics of organisms immutable units, incapable of modification, even when pitted against each other in pairs, as occurs in hybridiza-

tion of individuals having opposed characteristics? If the characteristics typically blend in the hybrid offspring, the theory of unit characters loses its main support; but if they typically do not blend, but reappear in the hybrid offspring, each in its pristine purity, then the theory of unit characters is supported and its corollary—evolution by mutation—follows. Hybridization of poultry shows that most characteristics do not blend and do reappear in subsequent hybrid progeny almost unaltered—*almost*, but not quite.

The Egg-laying of Chironomus annularis: JAMES G. NEEDHAM, Lake Forest, Ill.

Chironomus annularis, one of the larger midges of wide distribution in Europe and North America, occurs in the campus pond at Lake Forest College, where in May a number of new observations were made as to its manner of oviposition. The eggs are extruded while the female is hanging up among the leaves of the sedges at the water's edge. There occurs a preliminary flight back and forth across the water lasting fifteen to twenty minutes. This flight ends well in-shore, where the female settles and releases the egg masses upon the surface. The egg mass gradually settles beneath the surface, but remains attached to a little transparent float by a slender adhesive gelatinous thread which stretches out to a length of about six inches. The mass then drifts until this suspensory thread comes in contact with some submerged sedge leaf or other solid support, where it remains until hatched. It contains about 1,800 eggs, which hatch in about three days.

Some Notes on the Breeding Habits of our Ithaca Anura: A. H. WRIGHT, Cornell University.

Of the eight local anura, there have been identified the eggs of all in the field and of six in captivity. The mating embrace has been photographed with all excepting *Rana catesbiana*.

C. JUDSON HERRICK,
Secretary.

SCIENTIFIC BOOKS.

Applied Sociology. By LESTER F. WARD. Boston, Ginn and Co. 1906.

The clearness, brilliancy and vigorous defense of some pronounced doctrine which we have learned to expect from Professor Ward are characteristic of this book. It concerns real facts, not verbal distinctions; it delights by its cleverness of thought and style; it attempts to rehabilitate a particularly unpromising form of the Leibnitzian theory that proper education can create a millennium.

Very briefly, the argument of the book is as follows: The welfare of people in general (whom I understand the sociologists to mean by the perilous word society) is improvable by the control of inanimate and animate nature, including people themselves, by reason guided by science and ruled by justice. Justice means the satisfaction of every one's wants, so far as they are not outweighed by others' wants. There is reasoning capacity enough in all classes of society. Nature then does not to any degree worthy of consideration limit this control; the cause of weal and woe lies in nurture. The particular error of nurture which people should now reform is the inequality of knowledge; the many suffer because they are ignorant. The equalization of intellect will make happiness for all and will multiply a hundredfold the men and women whose eminent achievements in the sciences and arts free life from undesired labor, fear or sickness and add to it noble impulses and the means to realize them. The equalization of intellect will be secured by giving all knowledge to all men through a proper system of public education.

That the present misery of people in general is due largely to the unequal distribution of knowledge is assumed with little or no discussion of evidence or of the contrary hypothesis that one or two supermen who should next week find cures for cancer, gout and

asthma and an antitoxin against envy, worry and aimless fear, would advance the welfare of people in general more than a year's added schooling to a million of us.

The proposition that nature's limitations need not be considered by the reformer of society divides into two. The first is that though there are among individuals great differences by original nature in the capacity to reason and the capacity to acquire knowledge, there are by original nature no class differences. The evidence offered is an appeal to common experience. In fairness, Professor Ward ought perhaps to have stated that if any class, for instance teachers of science, are selected on the basis of a high standing in these capacities, his statement must soon become erroneous, additionally so if they select wives on the same basis. He has in mind chiefly the classes due to the selective action of interest in and ability to get wealth. In such cases it is hard to disprove his claim, though it would be much harder to prove it. The second division of his general proposition is that which men and how many shall be men of genius whose achievements can be transformed into the improvement of people in general is decided not by the gifts of nature, but by the conditions of nurture, the conditions being the advantages of education. His evidence for this is first a number of facts showing a certain probability that there are a hundred or more men of native ability enough to do the work of genius which only one man in fact now does, and, second, a rehearsal of the results of Odin's 'La Genèse des Grands Hommes,' which proves that the literary men of France have been born most frequently in châteaux and cities offering educational advantages. He somewhat naïvely takes Odin's facts to mean that 'genius is in things, not men,' disregarding the obvious certainty that if the achievements of men were due to original nature determined by immediate ancestry, we should still find men of achievement born in such cities, because of the certainty that such select and retain those likely on the Galtonian hypothesis to be the ancestors of men of ability. The very high probability of the birth of a man of ability in a château is perhaps more readily explained by the fact that men of ability come to own châteaux than by any very great educational advantages possessed by these rural homes of aristocracy. Odin's research in fact leaves the whole question of nature *versus* nurture where it was before. The appropriate data are records of children of known differences of ancestry under similar conditions of nurture and of children of known similarities of ancestry under different conditions of nurture. Data of the first sort, so far as obtained, contradict the author's view. Data of the second sort could be obtained without great difficulty in a comparison of the achievements of immigrants' sons brought up till, say, fourteen in a Russian Ghetto with their brothers brought up in the New York City schools.

Proof that education decides which ones or how many shall be leaders in achievement is really not so important to Professor Ward's general plea for 'all knowledge for all men' as it seems to be in his pages. There are, of course, two ways of viewing a man's achievement, as to its absolute amount and as to its amount in comparison with the achievements of his contemporaries. The former quality is the one of importance to people in general; the latter is the one by which a man gains eminence. No one doubts that the former is due largely to the environment; with the backing of a modern education I may make a discovery which Aristotle could never have made. The latter may be due almost entirely to the gifts of original nature and these may deny the world more than one Aristotle a century, and still the value of universal and advanced education may be extreme. The one failure in clearness of this volume is its failure to distinguish between absolute and relative achievement and to assign the proper social value to each. Professor Ward seems to think that a great desideratum is the elevation of several thousands a generation from mediocrity to eminence, but one is tempted to believe that his real faith is in absolute achievement and that he courageously makes an attack upon the Galtonian hypothesis because he misconceives it to limit absolute as well as relative achievement.

One may even abandon hope of and desire for the equalization of intellect and still keep the essence of Professor Ward's optimism. For every one of the desirable consequences of the equalization of intellect may be gained as well, if not better, by the same amount of effort and wisdom directed toward its *increase*. Space is lacking for me to defend this somewhat rash amendment, which the author would probably repudiate.

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Geometrische Kristallographie. By ERNST SOMMERFELDT, Privatdocent an der Universität. Tübingen. Pp. vi + 139, 31 plates and 69 text figures. Leipzig, W. Engelmann. 1906.

This is a book intended for advanced students of crystallography, written from the standpoint of the mathematician. Specifically limiting himself to the purely geometrical properties of crystal solids, the author develops his theme from the definitions of symmetry and in the first chapters defines the thirty-two recognized classes of crystals distinguished by varying grades of symmetry. These groups are variously classified and admirably illustrated by the plates which give for each of the classes the possible crystal forms and show very graphically the relations between them. In the following chapters the mathematical relations existing between the faces of the crystal are deduced and the fundamental crystallographic laws are stated. The mathematical processes, particularly vector analysis and the properties of determinants, which are chiefly involved are made the subject of a special chapter and their treatment is stated by the author to be original and to have an interest quite aside from the application to the problems of this work.

To the student actually engaged in the measurement and study of crystals the book offers little of practical interest except in the presentation of formulæ for the transformation of indices and axes which are here developed in very general form.

CHARLES PALACHE.

SCIENTIFIC JOURNALS AND ARTICLES.

THE contents of the *American Journal of Science* for September are as follows:

R. A. DALY: 'Abyssal Igneous Injection as a Causal Condition and as an Effect of Mountain-building.'

W. E. FORD: 'Some Interesting Beryl Crystals and their Associations.'

F. E. WRIGHT: 'Schistosity by Crystallization: A Qualitative Proof.'

M. R. CAMPBELL: 'Fractured Bowlders in Conglomerate.'

E. L. FURLONG: 'Exploration of Samwel Cave.'

T. L. WATSON: 'Occurrences of Unakite in a New Locality in Virginia.'

E. H. SELLARDS: 'Types of Permian Insects.'

R. H. ASHLEY: 'Analysis of Dithionic Acid and the Dithionates.'

The American Journal of Anatomy, Vol. V., No. 4, September 1, 1906, contains the following articles:

R. B. BEAN: 'Some Racial Peculiarities of the Negro Brain.' (With 8 tables, 16 figures and 12 charts.)

F. P. MALL: 'On Ossification Centers in Human Embryos.' (With 6 tables and 6 figures.)

J. L. BREMER: 'Description of a 4 mm. Human Embryo.' (With 16 figures.)

CHARLES R. STOCKARD: 'The Development of the Mouth and Gills in Bdellostoma.' (With 36 figures.)

THE July number of the *Journal of Mathematics* contains the following articles:

EDWARD KASNER: 'The Geometry of Differential Elements of the Second Order with respect to the Group of all Point Transformations.'

F. J. B. CORDEIRO: 'Gyroscopes and Cyclones.'

W. A. MANNING: 'On the Primitive Groups of Class Ten.'

VIRGIL SNYDER: 'On Certain Unicursal Twisted Curves.'

HENRY LIVINGSTON COAR: 'Functions of Three Real Independent Variables.'

DISCUSSION AND CORRESPONDENCE.

THE NATURE AND ORIGIN OF VOLCANIC HEAT.

IN SCIENCE for August 10 Dr. Elihu Thomson gives a theory of volcanic energy which he correctly describes as an extension of the ideas of Mallet. Having been recently much occupied with the theory of volcanoes in con-

nection with the larger problem of the cause of earthquakes, the formation of mountains and other phenomena connected with the physics of the earth, the discussion of Dr. Thomson has interested me, but I find it difficult to believe that either Mallet's original view or this ingeniously modified form of it is well founded. Dr. Thomson says: "A truly solid interior seems to be demanded by the accepted great rigidity of the body of the earth * * *." This view is very frequently expressed, but in my recent paper, 'Researches on the Rigidity of the Heavenly Bodies,' published in the *Astronomische Nachrichten,* No. 4104, July 10, 1906, it seems to be proved clearly and directly that the rigidity of the earth is not inconsistent with a fluid interior. And in another paper, not yet published, I think I have proved conclusively that a fluid substratum underlies the earth's crust. Accordingly, although I am an astronomer, and have shown in the paper above cited that the rigidity of the earth exceeds that of steel, and perhaps closely approaches that of nickel steel used in armor plate, it seems to me that geologists have adopted a mistaken course in conceding the solidity of the earth demanded by astronomers, for two reasons: (1) Rigidity does not really disprove internal fluidity; (2) the geological evidence of the existence of a fluid substratum is overwhelming, and this latter result is confirmed by my unpublished investigation on the cause of earthquakes.

In my paper on the rigidity of the heavenly bodies, above cited, the argument respecting the internal state of the earth is expressed as follows:

> It is, perhaps, worth pointing out that as a molten earth, in which the density follows Laplace's law, would have a mean rigidity of its layers equal to that of wrought iron, the hypothetical liquid interior would be much less easily deformed by tidal forces than has been generally supposed; so that reaction upon the enclosing crust probably would not be very conspicuous. The amount of this reaction would depend essentially upon the difference between the rigidity of nickel steel and of wrought iron, which is about one fourth of the rigidity of the whole earth as now constituted. Even if one supposed the interior of the earth to be liquid, the pressure to which it is subjected is so great that the tidal surgings of the nucleus, tending to deform the crust, would be comparatively ineffective; and if the crust of solid rock like granite be moderately thick, it is doubtful if the yielding would be sufficient to reduce sensibly the theoretical height of the fortnightly tides of the ocean. Accordingly it appears probable that the argument drawn from the tides against the fluidity of the earth's nucleus may in reality be somewhat less conclusive than the most eminent mathematicians have supposed. But from the accordance between the value of the earth's rigidity obtained from the theory of gravity with those found by Darwin from observations of the fortnightly tides, and by Hough from the prolongation of the Eulerian period for the variation of latitude, it seems impossible to escape the conclusion that the rigidity of our globe as now encrusted probably approaches that of nickel steel.
>
> It is scarcely necessary to add that the traditional theory long held by geologists that the earth's interior is a mass of mobile liquid in which currents still persist (cf. Fisher's 'Physics of the Earth's Crust,' second edition, pp. 246, 305, *et seq.*) when viewed from the gravitational standpoint is, therefore, found to be inadmissible. The great effective rigidity or viscosity of the matter within the earth makes any supposed motion of the imprisoned fluid quite inconceivable.

Thus, on the one hand, I have shown by strict mathematical reasoning from recognized data admitting of little dispute or uncertainty, that the rigidity is not inconsistent with internal fluidity, while on the other, I have made it clear that the free circulation of currents within the fluid nucleus would be impossible, owing to the rigidity depending on pressure. In fact the matter within the globe, as Arrhenius has also pointed out, may well be gaseous, simply condensed by pressure till it has an average rigidity exceeding that of steel. There are forces, however, which may produce motion just under the crust, which give rise to earthquakes.

Dr. Thomson's view that 'the flexures taking place in the earth's crust or in the outer portion of its mass may bring to bear upon deep-seated and, perhaps, already heated solid rock masses a sufficient pressure to cause them to readjust their positions,' and thus give rise to volcanic action, is in accordance

with many modern speculations on the cause of earthquakes, which ascribe these tremors to the slipping of rocks. My unpublished inquiry indicates that the true cause is very different. I regret that I am not yet able to give the chain of reasoning by which this result is established, but I may say that it is shown that one common cause underlies earthquakes, volcanoes, formation of mountains and islands, the elevation of plateaus, the feeble attractions of mountains noticed in geodetic operations, and the formation of great sea waves which frequently accompany violent earthquakes. All these phenomena are proved to be intimately connected, and I have shown that they depend upon a single cause, and that the earth's crust is underlaid by a fluid substratum in which the forces arise that disturb the crust.

It is nearly always assumed that changes in the earth's crust are due to secular cooling, but is that really so? When the truth comes to be known, I think it will be found that we have all been working on a false premise; a misleading hypothesis. In *Astronomische Nachrichten*, 4104, I have shown that rigidity prevents circulation, and, therefore, secular cooling would be confined almost entirely to the surface layers. Fisher and others have shown that the shrinkage due to the cooling of the crust is quite inadequate to account for the mountain folds observed upon the earth, which my researches show to depend on an entirely different cause.

Dr. Thomson is quite right in pronouncing against radium as a cause of volcanic action. The Hon. R. J. Strutt, of Cambridge, has shown that radium is very abundant in the rocks of the earth's crust, such as granite. If, therefore, we imagine radium to be the source of volcanic outbreaks, we should expect abundant eruptions to occur in all countries underlaid with granite—the United States, Europe, Asia, Africa, Australia, Brazil—which is contrary to observation. The well-known distribution of volcanoes invalidates the radium theory completely.

The Hon. R. J. Strutt, from his radium investigations, concludes that the internal temperature of the moon exceeds that of the earth. The observed low temperature of the lunar surface, however, contradicts this hypothesis, and thus we must be very cautious about ascribing too much to radium. The best experimental evidence available is that radium is a temporary form of matter, the energy of which must be renewed from other sources at intervals of 20,000 years, and thus it may play only an inappreciable part in the physics of the universe. So far, there is no evidence that it is an important cosmical agency.

The great forces which have most profoundly modified the world will be found to be familiar ones, which are overlooked mainly because they are so simple and so near at hand.

T. J. J. SEE.

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August 16, 1906.

THE NATURE OF EVOLUTION.

ON returning from Central America I find Dr. E. A. Ortmann's paper in SCIENCE of April 27 under the heading 'Dr. O. F. Cook's Conception of Evolution.' Lest the use of this label deceive any possible patrons of the genuine preparation, it may be desirable to point out that the most important ingredients have been omitted, so that the peculiar virtues of my evolutionary eye-water are entirely lost!

To suppose that progress in evolutionary knowledge can be made by the arbitrary limitation and redefinition of terms would imply, of course, a very shallow and merely metaphysical apprehension of the concrete data of the subject. Nevertheless, conceptions of evolution have to be communicated through the medium of language, and language has to be explicit if it is to convey definitely outlined ideas. When there is a practical reason for doing so, a term may be used in a special sense, subject only to the obvious desirability that linguistic changes, whether of new words or of modified meanings, be kept down to the lowest possible limits which will serve the purposes of clear exposition for the subject in hand.

The word evolution is often used as the name of the whole study of development—a branch of biology which includes the consideration of all the attendant factors or groups of phenomena. This generalized use is often convenient and wholly unobjectionable, but as soon as the question of the causes of evolution is raised the word obtains a much more explicit sense, serving then to designate the concrete physiological process in which the characters of species are changed. To insist that the progressive transformation of species be called variation, and not evolution, introduces a merely gratuitous confusion of words, since it removes both these terms, variation and evolution, from their primary significations.

The essential idea of variation is in its application to differences caused by the environment, that is, to transverse contemporaneous displacements among the individual members of a species, and not to the progressive, chronologically extended, longitudinal changes which represent the evolution of the species as a whole. These are two distinct modes of organic motion. To call them both variation does not prove that they are the same; it only facilitates such an assumption and tempts the unwary to take it for granted that anything which can modify or displace individual organisms in the transverse direction of variation, can also cause species to move in the longitudinal direction of evolution.

The kinetic conception avoids the verbal pit-fall and finds fundamental differences between the transverse contemporaneous variation of individuals and the longitudinal succession or gradual modification of form or structure in the species as a whole. Other forms of expression become necessary in order that the two kinds of phenomena formerly covered by the variation blanket can be compared and contrasted.

At such points the interests of general literature and of professional science often diverge widely. Specialists who are unwilling to use the word evolution in a definite physiological sense would have preferred some more technical means of designating this process of change in species. It might have been called, for example, symbasic prostholysis, in allusion to the fact that it is accomplished through the association of organisms into interbreeding groups rather than as a result of the environmental influences which induce variations. The species, and not the individual, is the unit of evolution; there are as many evolutions as there are segregated groups of organisms.

'The whole process of development of the organic world, from its beginning to its end,' which Dr. Ortmann prefers to call evolution, is a merely historical conception and not a biological process at all, except as it is made up of the separate evolutions of the millions of species of which the 'organic world' is composed. What is to be gained of clearness of thought or of expression by calling the general aggregate evolution, while denying this name to the specific units of development, is not easy to perceive. Dr. Ortmann would scarcely have thought to beguile us with the hollow formula that species change by variation and that variation therefore causes evolution. But why otherwise should it have appeared so astonishing to find the word evolution used in a particular as well as in a general sense? It is necessary here to fully reciprocate with Dr. Ortmann and 'positively decline to accept' his conception of evolution, if, as now appears, it is something which takes place in the organic world at large, but does not appear in the component species.

The jury must decide who has meditated the greater violence to the English language. It is certainly Dr. Ortmann who proposes the greater restriction of the word evolution, for he would permit its use only in the general and indefinite sense, as applying to the organic cosmogony as a whole, while I would recognize in addition a definite physiological meaning, when questions of evolutionary causes are being discussed.

The conception of spontaneous change in the characters of species may not be correct, but it is at least a conception, and it permits evolution to be thought of as a phenomenon separate and distinct from accidents of en-

vironment which may intensify the normal inequalities of individuals (variation), as well as from accidents of geographical distribution by which groups of individuals may be subdivided (speciation). All these are evolutionary matters in the general sense already alluded to, but underneath all the multiplicity of more or less pertinent data and speculations is this process of change in species. It may be denied, as in the mutation hypothesis of Professor de Vries, that there is such an evolutionary motion of specific groups, but all will be ready to admit that if such progressive changes of species take place they represent the real center and essence of the subject of evolution, the physiological process of which it is of so much importance to know the conditions and causes.

The fact that evolutionary literature has become so vast a congeries of speculations should not make us forget what it is all about. Certainly it affords no sufficient reason for avoiding the use of the word evolution in describing a conception in which a continuous modification of the specific type is treated as a normal condition and requisite of organic existence.

After writing the above I have come upon a further article by Dr. Ortmann in SCIENCE of June 22, in which he appears reconciled to the new term speciation, in spite of the hoary antiquity and other objectionable features of the idea which led to the suggestion. This is very gratifying. But at the same time it becomes even more obvious than before that the title of Dr. Ortmann's previous article was misleading, for in this last review of developmental theories he leaves out of account altogether the very conception he has so recently claimed to discuss, a conception which, whether old or new, true or false, is radically diverse from any of the alternatives treated. The distinction of speciation from evolution has been taken, evidently, as the whole 'conception,' whereas it is only an incidental feature. The mistake is due, no doubt, to my continued failure to give the kinetic point of view an adequate presentation, but it may be that the discussion has now reached a stage where the distinctions can be outlined more clearly than before.

Without denying the general literary sense in which anything which has even a remote bearing or influence on evolution may be considered a factor, we may return once more to the kernel of the whole matter, the question of the true, actuating causes of evolution. The differences between the alternative interpretations may then be definitely located.

It is evident that Dr. Ortmann is discussing a generalized abstraction compounded out of the four factors or groups of phenomena, variation, inheritance, adjustment and speciation. The kinetic conception, on the other hand, treats evolution as a concrete process, carried forward through two factors which are very different from the other four, since they are resident in species and do not depend upon environmental influences. Dr. Ortmann's unwillingness to recognize evolution as a concrete process can now be understood, for the factors upon which he relies are incapable of explaining such a process, as a brief examination will show.

Inheritance, to take the oldest idea first, is a general condition of organic existence, but it has no evolutionary implication. If there were no inheritance there would be, of course, no evolution in the biological sense, but this is no indication that inheritance causes evolutionary progress. Many writers have consistently denied that inheritance causes, or tends to cause, evolution. They hold, on the contrary, that like would produce like indefinitely unless acted upon by disturbing agencies of the environment. Adaptation or adjustment to environment, whether by natural selection or otherwise, is not a cause of evolution, but rather a result, a meeting by evolutionary processes of requirements imposed by external conditions. Speciation, or the diversification of segregated groups of organisms, is also clearly an evolutionary result instead of a cause. Even variation, in the sense in which the word appears to be used by Dr. Ortmann, to indicate the effects of external influences upon organisms, has not been shown to have any connection with evolution, notwithstand-

ing the persistent faith of the apostles of mechanical causation, such as Cope, Hyatt, Dall and Dr. Ortmann himself. In short, it does not appear that the true, efficient causes of evolutionary motion are to be found in the phenomena covered by these four terms, in the senses in which they are employed by Dr. Ortmann.

The conception of which Dr. Ortmann announced a discussion, but has not really considered, definitely abandons these supposed causes of evolution as inadequate and irrelevant and would elevate to primary importance two considerations generally ignored entirely, or given very subsidiary attention. These are (1) *heterism,* the normal diversity of the individuals of which species are composed, and (2) *symbasis,* the free interweaving of the lines of descent of these normally diverse individuals.

The progressive transformation of species is made possible by these two factors, and it has not been shown that any of the others are to be reckoned as direct or actuating causes, notwithstanding the vast amount of attention devoted in the last half century to the many static doctrines under which evolution has been ascribed to one or another form of environmental influence.

It may yet be ascertained, perhaps, that the environment does in some way exert actuating influences upon evolution, but it is not too much to say that up to this time all theories of environmental causation remain purely speculative. Heterism and symbasis, on the other hand, though long neglected as evolutionary causes, are thoroughly established facts of obvious implication. Individual diversity persists in spite of uniformity of conditions, and interbreeding is everywhere coincident with evolutionary progress. Even on purely mathematical grounds it becomes apparent that the resultant of the continuous interweaving of diverse lines of descent must be a progressive transformation of type.

Dr. Ortmann points out that de Vries has confused speciation with variation, but might be charged in turn with having confused evolution with variation, just as so many other writers have confused evolution with speciation. Why so many attempts at leaving Hamlet out of the play? Each is a testimony of the surviving strength of the old pre-evolutionary idea that species are normally constant, uniform and stationary, so that evolution would need to be caused and conducted by external agencies of the environment. Though supported by no facts, the doctrine of environmental causation is still being advocated in many quarters in a manner strongly reminiscent of the defense of special creation, by Owen and Agassiz. The kinetic conception of evolution is in respect of causality as different from environmental evolution as that is from special creation, for it holds that species are not made by the environment, but that their development goes forward as a manifestation of qualities inherent in their very constitution.

The progressive modification of specific groups of interbreeding organisms is as truly a phenomenon, as much of a fact, as any of our so-called factors, natural selection, adaptation, variation, heterism, isolation, speciation, etc., which help to make up the evolutionary drama. Evolution, in the kinetic version, is not only the title of the play, but the name of the principal rôle. It is no longer restricted to the dialogue of the subordinate players, like a mere ghostly abstraction. The actions and relations of the various attendant circumstances continue to give us very important aid in understanding the workings of evolution, but they are no longer allowed to explain it away into a nebulous compound of definitions. Some of the persons are of the immediate family of evolution, but others have no direct relationship at all, though they may appear often on the stage and perform important parts. Thus natural selection is the father of adaptation, but is related to evolution only in the indirect, restraining capacity of guide and counselor. Evolution and isolation are parents of speciation, but are related only by this marriage, and had no previous consanguinity. Environmental variation is at most only an uncle of evolution, not the direct progenitor. The remaining minor

factors constitute the retainers, servants and domestic animals of the evolutionary household, but this does not give them places in the genealogy of evolutionary causes.

Dr. Ortmann is annoyed by incidental changes in familiar lines and stage directions, which he does not hesitate to charge to carelessness and ignorance, forgetting, for the time, that the whole play is being recast, and that the merits of the new rendering are to be judged by its conformity with the facts of nature, rather than by reference to the traditions of evolutionary literature.

O. F. COOK.

WASHINGTON,
July 18, 1906.

TEMPERATURE CORRECTIONS OF SUGAR POLARIZATION.

TO THE EDITOR OF SCIENCE: There has come to me a belated copy of SCIENCE (April 20) containing Dr. Wiechmann's review of my work on the polariscope, in which he discusses my treatment of the subject of temperature corrections of sugar polarizations. As Dr. Wiechmann seems to have quite misunderstood what I have stated concerning temperature corrections, in view of the great importance of the subject I have ventured to bring it again before your readers. Dr. Wiechmann takes a quotation from my book (p. 44) as to the fact that the values of temperature influence are well established [by Andrews, Wiley and Schönrock for instance] as a statement endorsing the use of temperature corrections in raw sugar polarizations. He quite overlooks the statement (on the same page, I think; I have no copy at hand) that such corrections can be *quite fallacious* if proper conditions are not observed; and yet further (p. 97?), under 'Errors of Commercial Polarizations,' where I say, that owing to other inherent errors of raw sugar polarizations it is doubtful whether application of such corrections brings any nearer approach to the true saccharimetric value; and hence, such corrections are questionable in raw products at least.

The present status of the case, as I understand it, is this:

It is well established that temperature change exerts an influence on sugar polarizations made according to standard method.

The quantitative value of such influence, when pure sugar is polarized, is known within narrow limits of error.

Owing to obscure compensatory errors, not yet possible of measurement and inherent in raw sugar polarizations, the correction of temperature influence is inadvisable as generally leading to an exaggerated sugar value. Further, application of temperature correction values gives quite fallacious results if the same constant temperature of solutions and apparatus is not maintained.

As the total errors or raw-sugar polarizations apparently come nearest to balance at 20° C. this temperature has been adopted as a rigid standard by the International Sugar Commission.

The fact that the International Commission has adopted a rigid temperature standard shows that the influence of temperature is recognized. It follows that polarizations made at temperatures other than 20°, as necessarily here in the tropics where the afternoon temperature is now from 28 to 30°, that some correction should be made for temperature influence, not to the standard, of 17.5°, but to 20°. The well-known case cited by Dr. Wiechmann simply emphasizes that 'temperature corrections' may be applied with quite fallacious results, without in any way casting doubt on the 'alleged' influence of temperature on the specific rotation of sucrose which obviously is but a small part of the influence of temperature on sugar polarizations.

Here might be raised the interesting and subtle question whether the sugar values of the saccharimeter standardized at 20° are identical with those of the instrument standardized at 17.5° when *raw* sugars are polarized.

In the whole discussion, what are facts of experiments in temperature influence on pure sugar polarizations must be carefully differentiated from what is the most consistent and fairest way to estimate the sugar value of a commercial product, by the indications of a method which at its best is subject to errors as

yet incapable of exact control; errors which are small but yet significant in the light of the magnitude of sugar transactions.

Geo. W. Rolfe.

Toa Baja, Porto Rico.

SPECIAL ARTICLES.

A BURIED TREASURE OF ECONOMIC ORNITHOLOGY.

In 1865 there was published in New York a work on entomology by Dr. Isaac P. Trimble. Though dealing primarily with insects, the book contains the most original and accurate observations then made in economic ornithology in America. Concealed under its caption, 'A Treatise on the Insect Enemies of Fruit and Fruit Trees,'[1] is a mine of information concerning the relations of birds to some of the worst pests horticulture has to endure.

The attention to minutiæ and the scientific accuracy with which the data were gathered are remarkable for the time, and the line of investigation, undeveloped as it was. While Samuels, Michener, Flagg, Bryant, Jenks and others were working in the field of economic ornithology at that or a little earlier period, the work of few, if any of them, is marked by the wealth of definite information that characterizes the labors of Trimble.[2] His specific identifications of substances found in the stomachs and his technique of determination savor strongly of present methods, and at once distinguish his work from most of the contemporaneous articles on the subject, being, as often they were, mere compilations of Audubonian and Wilsonian phrases.

Dr. Trimble went to the birds themselves for his information. He says:

> I have killed a very large number of birds and examined the contents of their stomachs, especially of those frequenting orchards. Most of these examinations have been made with a magnifying glass, and many with the microscope. Some species I have shot at short intervals during the season, to know how far their food varied at different times; and I have thus ascertained that the contents of the stomach at any one time are not an infallible criterion by which we can determine the usual food of that bird. On the fifth of May, 1864, I shot seven different birds; they had all been feeding freely on small beetles, and some of them on nothing else. There was a great flight of these small beetles that day; the atmosphere was teeming with them. A few days after the air was filled with ephemera flies, and the same species of birds were then feeding upon these (p. 113).

Here he recognizes the law that birds as a rule feed upon substances most abundant about them, a fact with which we are constantly brought face to face in the more extensive investigations of the present time. Continuing the comparison, as we identify some beetles by the scutellum or chrysalides by the cremaster, he also had his little niceties of method, of one of which the following is an interesting description:

> The eyes of most insects are wonderfully formed. They may be said to be compound eyes, each made up of many hexagonal lenses. If a comb of the hive bee, containing one or two hundred cells, could be photographed down to the size of the head of a pin, it would look somewhat like the eye of a beetle. Each eye of the Curculio contains about 150 of these lenses. The number in the eyes of butterflies, moths or dragonflies amounts to many thousands. In some microscopic experiments made last summer upon the eyes of plant lice from different trees and plants, it was found that the number of lenses in the eyes of these insects varied from every tree and plant. Each thus proved to be a distinct species, no matter how close the resemblance in other respects. Thus, should the rose bushes of the garden or a neighborhood be cleared of these pests they would not be reinhabited by those from other plants. While examining one of these aphides it brought forth a young one, and this in turn being tested its eye was found to contain the same number of lenses as the mother's. This peculiarity of the eyes of insects, and the knowledge of the exact number of these lenses in the eyes of each species, become

[1] William Wood and Co., New York, 1865, pp. 139, pls. XI. This title is not to be found in Coues's bibliography nor in any list of publications concerning economic ornithology. By entomologists, however, the publication is frequently cited sometimes even for its ornithological matter, and its author is deemed entitled 'to a prominent place with the early economic entomologists of the country.'

[2] The latter says, however, of the work of Flagg, 'Of the many contributions to the history of birds, I have met with none so interesting as this' (p. 113).

important in investigations where only the comminuted parts can be obtained. In a long series of examinations of the contents of the stomachs of birds, for the purpose of ascertaining more positively how far the insectivorous kinds frequenting orchards are useful in feeding upon these enemies of fruits, the microscope has enabled me to demonstrate many facts otherwise difficult to prove (pp. 37–8).

How he made use of the little point about the curculio he describes in a fascinating manner:

Killed an oriole (Baltimore)—a male of one year; it did not have the brilliant colors of the fully matured bird. I followed it from tree to tree for a long time, listening to its peculiar notes, and watching its habit of feeding. In a very careful examination of the contents of the stomach, what appeared to be the wing-cases of a *Curculio* were discovered; and on further scrutiny I found the head with proboscis attached. This was exciting. Here was some evidence that one bird at least was feeding upon our most formidable insect enemy; but as the *Curculio*[3] is one of a large family of the Coleoptera, and many of the different species bear a striking resemblance to each other, both in form and size, it was necessary to pursue the investigation still further. On placing the wing cases under the microscope, the peculiar protuberances—the brilliant metallic colors—the hairs resembling pearls, when a strong light is directed upon them, that I had so often seen, were all visible. The mutilated head was now tested. There was the proboscis with its cutting apparatus, and the 147 lenses in the eye.

I have examined the eyes of many others of this family, but not one of them has the same number of lenses. The larger species figured in Pl. 5, Fig. 10, has more than double this number.

All this evidence taken together was ample to settle this question forever. The Baltimore eats the *Curculio*![4] Let the death of this martyred bird secure the protection of its race for all future time. The remains of three other beetles and three leaf-curling caterpillars[5] were also found in the stomach of this oriole (p. 77).

The Baltimore Oriole Eats the Curculio. Probably many other birds that frequent the orchard in pursuit of food, and feed upon beetles do the same thing; but none of them search it out exclusively. Therefore, good as most of the birds are as consumers of injurious insects, and though the world, for our purposes, would soon become topsy-turvy without them, the birds can not be relied upon to subdue or control the curculio (p. 85).

Here again our author gives an instance that agrees with the results of a much greater amount of study of the food of birds. That is, birds simply act as a check upon insects, sometimes as a minor one, sometimes the chief. Such must always be the case, for obviously no species can continue to exist if it exterminates its food supply.

Dr. Trimble found feathered enemies of another great insect pest, the apple-worm, or codling moth (*Carpocapsa pomonella*). This is the very task at which an entire state (California) set its energies. Indeed the little codling moth demands a good share of the attention of economic entomologists over the whole world. Our author's efforts in searching out birds that feed upon this insect are particularly interesting. He treats the work of the downy woodpecker in this direction in detail and gives a plate (X.) in figuring this bird, the yellow-bellied woodpecker and the chickadee, so that any one, whether he be acquainted with birds or not, can recognize the friends and the supposed enemy. On the same plate is shown some of the downy's work —the exterior of a piece of bark with the little round holes made by the bird's beak, and the inner side of the same showing how straight and true these tunnels were drilled through to the chrysalis of the moth. He found them at this work from September 8 (p. 135) to April 21 (p. 115), and in his accounts of every place he made observations, Dr. Trimble mentions these holes in the bark of the apple trees. Concerning a trip in Morris County, N. J., he says:

[3] His name for the curculio is *Curculio argula* Fabr., which in modern terminology is *Conotrachelus nenuphar*. The larger species he mentions is really on Pl. VI., Fig. 10, and, he explains, was figured from a specimen taken from the stomach of a toad. From stomachs of these animals he says he has often obtained different species of beetles.

[4] Now known to be eaten by many other species of birds.

[5] Tortricina. Also found by Dr. Trimble in the stomachs of the wren and catbird.

Here I was gratified in being able to ascertain how he finds where to peck through the scales of bark, so as to be sure to hit the apple worm that is so snugly concealed beneath. The sense of smell will not account for it. Such an acuteness of one of the senses would be beyond the imagination. Instinct, that incomprehensible something, might be called in to explain to those who are satisfied to have wonders accounted for by means that are in fact only confessions of ignorance. Birds have instincts undoubtedly—so have we; but they are mixed up confusedly with other faculties. Most of the actions of insects are purely instinctive and utterly unaccountable. But the apple moth is not a native of this country—the downy woodpecker is. The bird would not have been created with a special instinct to find the larva of a moth that did not exist in the same country. Other insects live under these scales of rough bark; but in very numerous examinations, I have not seen such a hole made except when leading directly into the cocoon of this particular caterpillar. This little bird finds the concealed larvæ under the bark, not from any noise the insect makes; it is not a grub of a beetle having a boring habit, and liable to make a sound that might betray its retreat, in seasons of the year when not torpid. A caterpillar makes scarcely an appreciable noise, even when spinning its cocoon, and when that is finished it rests as quietly within as an Egyptian mummy in its sarcophagus.

There is no evidence that the downy woodpecker ever makes a mistake; it has some way of judging. The squirrel does not waste time in cracking an empty nut. There is no reason to believe that this bird ever makes holes through these scales merely for pastime, or for any other purpose except for food. He knows before he begins that if he works through, just in that spot, he will find a dainty morsel at the bottom of it, as delicious to him as the meat of the nut is to the squirrel. But how does he know? By *sounding* —tap, tap, tap, just as the physician learns the condition of the lungs of his patient by what he calls percussion.[6] The bird uses his beak, generally three times in quick succession—sometimes oftener; then tries another. Watch him. See how ever and anon he will stop in his quick motions up and down, and give a few taps upon the suspected scale, and then test another and another, until the right sound is communicated to that wonderful ear (pp. 116–7).

Besides studying the downy woodpecker in the field he examined the stomachs of three of them. One contained *a codling moth larva* and some beetles. Another held one beetle, the heads of *two codling moth larvæ* and of three small borers. The third contained beetles and grubs unidentified.

The black-capped chickadee was also found to feed upon the codling moth. Three specimens were examined, one having eaten eggs of lepidoptera and beetles, another four seeds and a number of 'pupæ of very small beetles, such as take shelter under moss and old bark on trees,' while in the stomach of the third were *five larvæ of the codling moth.*

One of these had been so recently taken, and was so little mutilated, that it was easily identified. The heads of the other four appeared identical when examined with a pocket-glass; but when subjected to the test of the microscope, there was no possible room for doubt. The day had been dry and windy, following a warm wet day and night; and it is in just such weather that the bark of the buttonwood, shellbark hickory, and other shaggy trees, will be found curling out and falling off.

I have never seen anything that would lead me to believe that this minute bird makes the holes in the scales of bark that lead directly to the cocoons of these caterpillars; they are made by the downy woodpecker, and probably by it alone. The chick-a-dee most likely finds these worms only or chiefly on such days as this, when the warping of these scales exposes them to the prying eyes of these busy little friends. This bird is one of the guardians of the orchard; quick, active, always on the alert; assuming any position; sometimes hanging by one foot on the under side of the large limbs, where these caterpillars rather prefer to conceal themselves; and now proved to feed freely upon the second in importance of the insect enemies of our fruits. Let no one hereafter kill a chick-a-dee without being made to feel that he has done a most disgraceful deed (p. 120).

In further proof of their good work he says:

For several mornings in succession I noticed that the piazza was strewn with the cocoons and broken pupa cases of the caterpillars (species?) that were so numerous in September; sweep them off, and soon they would be there again. It was the work

[6] This description of the woodpecker's search for food bears a remarkable resemblance to a forty-years later (1905) account of a percussion process (Perkussionsverfahren) by a German investigator, Dr. Wilhelm Leisewitz.

of the chick-a-dees. The piazza is a high one, and extends on three sides of the house. Hundreds of caterpillars formed their cocoons in the chinks and crevices of the ceiling, and there the little birds found them (p. 121).

Among notes on other birds which he had studied, but which were not found to destroy either of the insect pests he treats, is quite a long dissertation upon the yellow-bellied woodpecker. After watching one drilling holes in an apple tree for some time, he wrote the following:

I shot this poor bird, expecting to find positive evidence in the stomach of what it made these holes for—and found two seeds or pits[1] (of which one and half the other are represented in Fig. 9, Plate 10), with the purple skins of the same fruit, seven small ants, and one insect of the chinch bug kind about the size of those found in the beds of some taverns. But of bark or sap there was not even a trace.

Later in the day I shot another of the same species of bird in an old orchard out of town. The stomach of this one contained the pulp of an apple and one ant—nothing else. This one was on the upper part of an apple tree, and was not pecking or sounding. The investigation of this bird so far is unsatisfactory. I have seen no evidence yet that these holes are made in search of food. Ants are certainly found sometimes about these holes, and apparently in pursuit of the sap that exudes from them; but the idea suggested by some, that the birds make them to attract these ants by such tempting baits, is a palpable exaggeration of the reasoning power of this bird (p. 118).

Notwithstanding the subsequent great increase of knowledge in regard to birds, the puzzling problem of the sapsucker is in almost as unsatisfactory a state at the present as when Dr. Trimble was making his pioneer investigation.

In the case of some other birds, also, of whose status we are none too sure, the author's treatise presents data. Among such birds are warblers and creepers, mentioned in the following paragraph:

The season of 1864 will be memorable as the year of aphides, or plant lice. The first crop of leaves on many of the apple trees was so alive with a species of these pests that most of them fell off, causing also a profuse shedding of the young apples. Warblers of many kinds, then just coming on from the south, creepers, wrens and even sparrows, as well as many other kinds of birds, fed upon these the livelong day. The throats, and even the back parts of the beaks of some of them, would be found lined with these aphides, many of them still alive, and their stomachs containing a juice that would leave the hands colored as they are after crushing these insects. The creases or folds of the stomachs were lined with what appeared to be an accumulation of the hairs of caterpillars, but under the microscope were found to be the legs of these plant lice—thousands and thousands of them (p. 114).

From stomach examination he learned, also, that the bobolink eats cankerworms. "I have found his stomach filled to repletion with these troublesome caterpillars" (p. 114). The same pests he finds are eaten by another bird.

I have found as many as thirty-six young canker worms in the stomach of one (cedar-bird), and I have known companies of these birds come after a species of canker worm on a cherry tree, several times every day, for two weeks, during the last summer; and when I saw them afterwards feeding upon the cherries, I felt that they had saved the crop, and were entitled to a part of it. This and several other species of birds are very troublesome to grape as well as cherry growers, and I know men who are threatening to shoot them next year. But there are two sides to this question. The grape crop would be a precarious one if its insect enemies were not kept in check, and there is no protector so efficient as the birds. Save your cherries and grapes if you can, but better lose a large portion than kill the birds (p. 26).

In the stomachs of meadow-larks he found oats and wheat and thousand legs (*Julus*), and in one of a crow shot in February a few beetles and about fifty grasshoppers.

Some of these, he says, were of the variety so plentiful late in fall, but the greater part were of that kind that we find in the spring about half grown, and not yet having their wings matured—such as are at full size in July. Many do not know that grasshoppers live through the winter; many do not know that crows eat insects. The farmers, when they see flocks of crows ransacking their fields and meadows, instead of offering bounties for their destruction, should be thankful

[1] Judging from the illustration these are evidently the seeds of the dogwood, *Cornus florida*.

that there is something to keep the grasshoppers and other insects in check (pp. 101–2).

The statements in this paragraph seem eloquent of the spirit of the man. He found out many things that others did not know and strove after a genuine appreciation of the relations of things about him. He was one of the earliest to take the direct method of doing this in the field of American economic ornithology. That his work has remained unnoticed because of a name is a pity. His observations are not trite to-day, but, on the contrary, they possess freshness, almost novelty. That such is the case after a lapse of more than forty years is a significant tribute to an able and original man.

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GALL-INSECTS AND INSECT-GALLS.

In no phase of biological work are the results of the neglect of cooperation more apparent than in the study of 'insect-galls' and 'gall-insects.' In fact many of our best scientists fail to recognize the two closely related subjects as distinct and continue to use the terms synonymously, although the one is botanical while the other is entomological. The entomologists have given considerable attention to the study of gall-insects, but the study of insect-galls has been woefully neglected, while lack of cooperation has made much of our entomological knowledge of questionable value.

For some time the writer has been bringing together the literature upon these two subjects, and it may be of interest to the readers of Science to see a summarization of the work in hand at this time. The six orders of insects containing gall-makers, include 16 families, 77 genera and 583 species (not counting leaf curlers and those for which galls have not been described, but which we have every reason to suppose are true gall-makers). These galls arranged with reference to the host plants show the following: 26 orders, 51 families, 90 genera and 188 species affected. Of the 26 orders 12 show only one family in each to be affected; of 51 families 26 have only one genus affected; of the 90 genera 63 have only one species in each affected. The genus *Quercus* leads with 45 affected species and *Salix* is second with ten affected species.

These figures are absurd and every student of either entomology or botany believes that the list of host plants should be much longer.

Let us look for an explanation: (1) The botanist has given practically no attention to the subject, although every herbarium of importance contains more or less galls that have been incidentally collected. (2) The entomologists have studied the insects rather than the galls and too often their descriptions of the galls have been indefinite. Furthermore, the determinations of the host plants in many cases have been uncertain or entirely omitted. Papers have been published without giving the common names of the hosts, others with only the common names, others with only the generic names and others in which it is evident that the determinations are incorrect. A well-known botanist in examining my list recently remarked: 'Here you have a number of galls attributed to a single host plant, while I have seen galls on four different species of that genus.' Yet, I have reason to believe that I have examined practically all the North American literature on the group of gall-formers to which he referred. I have also received from well-known entomologists, galls of the same species bearing different names.

The study of the insect-galls and their makers, parasites and inquilines presents a very large number of interesting problems of which the following may be mentioned: (1) We know very little concerning the dimorphism of the American species. (2) We know nothing of the relation of the distribution of the insect, to the distribution of the host plant. (3) We have very little reliable data concerning the ability of any one species of insect to produce galls upon more than one species of host plants. (4) Very little has been done on the anatomy of the American galls. (5) Very little has been done on the physiology of the galls.

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ALIMENTARY PARASITES OF FELIS DOMESTICA.

BELOW are given the records of the kind, location and extent of the intestinal parasitism of several specimens of *Felis domestica* examined at Meadville, Pa., during the year ending June, 1906. Only three species of parasites were found: *Ascaris mystax, Tænia crassicollis* and *Dipylidium caninum*. The two species of tapeworms were identified by Professor H. B. Ward, of University of Nebraska.

TABLE 1.

	No. of Subjects.	Subjects Affected.	Not Affected.	No. of Parasites Found. Total.	Average.	Max.	Min.
A. mystax.....	13	9	4	134	15	37	2
T. crassicollis..	17	5	12	13	2.6	5	1
D. caninum.....	17	3	14	28	9.3	16	5

Table 1 gives a general record of the extent of parasitism. This shows that parasites are abundant in *Felis domestica*. It will be seen

TABLE 2.

Detailed Record of Infection of Twelve Individuals.

Subject.	Kind of Parasite.	Age of Subject.	Total.	Stomach.	Duodenum.	Jejenum.	Ileum.	Large Intestine.
1 ♂	A. mystax.	sleek,	0	0	0	0	0	?
	T. crassicollis.	full	5	0	0	0	5	?
	D. caninum.	grown.	0	0	0	0	0	?
2 ♀	A. mystax.	sleek,	11	0	9	2	0	?
	T. crassicollis.	full	0	0	0	0	0	?
	D. caninum.	grown.	0	0	0	0	0	?
3 ♀	A. mystax.	scrawny,	16	0	14	2	0	?
	T. crassicollis.	¾	0	0	0	0	0	?
	D. caninum.	grown.	0	0	0	0	0	?
4 ♀	A. mystax.	scrawny,	0	0	0	0	0	?
	T. crassicollis.	old.	3	0	0	0	3	?
	D. caninum.		0	0	0	0	0	0
5 ♂	A. mystax.	scrawny,	22	2	18	2	0	0
	T. crassicollis.	full	0	0	0	0	0	0
	D. caninum.	grown.	0	0	0	0	0	0
6 ♀	A. mystax.	¾	37	3	22	4	2	6
	T. crassicollis.	grown.	0	0	0	0	0	0
	D. caninum.		0	0	0	0	0	0
7 ♀		sleek, full grown.	No parasites found.					
8 ?	A. mystax.	½	2	0	2	0	0	0
	T. crassicollis.	grown.	0	0	0	0	0	0
	D. caninum.		0	0	0	0	0	0
9 ♂	A. mystax.	large,	20	0	17	3	0	0
	T. crassicollis.	sleek,	1	0	0	1	0	0
	D. caninum.	butcher's cat.	0	0	0	0	0	0
10 ♀	A. mystax.		12	2	9	0	0	1
	T. crassicollis.	?	0	0	0	0	0	0
	D. caninum.		0	0	0	0	0	0
11 ♀	A. mystax.	scrawny,	3	0	3	0	0	0
	T. crassicollis.	1½ year.	0	0	0	0	0	0
	D. caninum.		16	0	0	0	16	0
12 ♂	A. mystax.	old,	11	1	9	0	0	1
	T. crassicollis.	pet.	0	0	0	0	0	0
	D. caninum.		0	0	0	0	0	0
Totals.	A. mystax.		134	8	103	13	2	8
	T. crassicollis.		9	0	0	1	8	0
	D. caninum.		16	0	0	0	16	0
Grand Total.			159	8	103	14	26	8?

that 88 per cent. of all the subjects examined were infected by some one of these parasites and that 76 per cent. of all the subjects infected were infected by *Ascaris mystax*.

Table 2 gives a detailed record of the age and sex of each subject and the location and extent of the parasitism.

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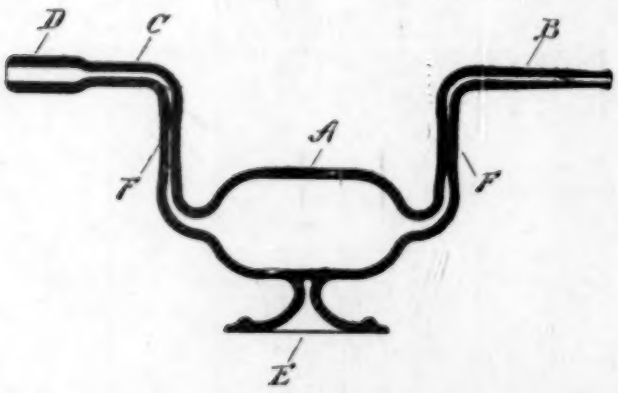
AN IMPROVED PYKNOMETER.

In the course of investigation into the function of the bones of the middle ear there was occasion to determine the specific gravity of those ossicles and their constituent parts. The parts are very small, so that the most suitable method for determining their specific gravities seemed to be that employed by Hammerschlag for determining the specific gravity of a drop of blood.

The specific gravity of methylene bromide, which is greater than that of bone, was gradually reduced by adding ether to it, until the piece of bone under investigation which had been dropped into this solution, remained suspended therein. At this point the specific gravity of the particle of bone was, of course, the same as that of the solution, which latter was then determined.



I attempted to use the pyknometer with a perforated stopper to obtain equal quantities of the solution and of distilled water for the purpose of comparing their weights; but found the instrument unsatisfactory for exact determinations.

The water did not overflow the stopper as readily as the solution, forming a much larger cap over the perforation so that an equal quantity of water and of methylene bromide could not be obtained. Furthermore, during the necessarily slow process of careful weighing, three to four mg. of the solution would evaporate. Besides, unless special care was taken, a rising temperature would cause the contents to overflow.

To obviate these difficulties, I designed a pyknometer here illustrated in vertical section.

The cylindrical body or bulb, of convenient size *A*, is provided at one end with a capillary inlet—outlet tube or arm *B*, bent as shown; at the other end with a similar tube or arm *C*, having a mouthpiece *D* for drawing in and blowing out the liquid. The arms *B* and *C* are marked as at *F*, *F*; the whole is mounted on a suitable base such as *E*; by drawing in or blowing out, the exact quantity of liquid can readily be obtained; the lumen of the arms at the marks *F*, *F* may be extremely narrow and a perfect gauge of quantity be thereby had; no attention need be paid to changes in temperature after the pyknometer is once filled; the lumen being narrow and the arms long, what little evaporation might possibly take place is beyond detection; the instrument is conveniently cleaned and dried by rinsing it with a volatile solution and then passing an air current through it.

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CURRENT NOTES ON METEOROLOGY.

THE CYCLONE OF SEPTEMBER 22–28, 1905, IN THE PHILIPPINES.

The *Bulletin* of the Philippine Weather Bureau for September, 1905, lately received, contains an excellent account of an important tropical cyclone which swept over the Philippines from the twenty-second to the twenty-eighth of that month, over a belt more than a hundred miles wide. This cyclone has been given the name *Cantabria*, after one of the vessels which was wrecked by the storm. The place of origin seems to have been in long. 142° E., and lats. 11°–12° N., between the islands of Guam and Yap. It moved west to Samar, and then northwest to the mainland,

at an average speed of 13.5 miles an hour. Several interesting reports were received concerning the passage of the central 'eye.' Thus, Capt. T. A. Hillgrove, of the cutter *Basilan*, at anchor, noted:

> Between 8 and 9 P.M. wind and sea suddenly died down, the sky cleared, and stars became visible. The calm lasted for fifteen minutes. The barometer remained 10 mm. below the graduated glass (700 mm.). After the calm, the wind rushed in from the southeast with hurricane force, and the barometer began to rise.

Before the 'eye' the wind was north. The *Basilan* did not pass through the exact center. The *Pathfinder*, ten miles south, experienced but three minutes of calm. The true center passed between the two vessels, and was, therefore, of very small radius. Later on, observations show that the calm central area increased in size. At Manila, where the center was 24 miles from the city, wind velocities of 90 to over 100 miles an hour were recorded. There is evidence that both ascending and descending winds were produced. In one case roofs fell in, as if overwhelmed by a weight on top. The ocean swell was particularly heavy, and had much to do with the loss of several vessels, including the *Cantabria*. We wish to call special attention to the very complete set of illustrations which accompany this report, including views of damage done on shore; of wrecked vessels; maps of the cyclone track and of the weather conditions; and reproductions of numerous instrumental records.

KITE FLYING IN INDIA.

THE extent to which scientific kite-flying has made its way around the world is evidenced by the publication, as Vol. XX., Part I., of the famous *Indian Meteorological Memoirs*, of 'An Account of the Preparations made for Determining the Conditions of the Upper Air in India by Means of Kites.' The writer is J. H. Field, deputy meteorologist; the date of publication, 1906. One of the chief objects of the work was the determination of the distinctive characters of the monsoon currents in India, leading to other questions in connection with the penetration of the Bengal monsoon current into the country along the base of the Himalayas. The flights took place between August 26 and September 12, 1905, a short distance (9 kms.) from Karachi City. The results show that a nearly saturated stratum of air from the sea extended from about 10 meters above sea-level upwards to a level which rose from 500 m. on August 27 to 1,130 m. on August 31. After that day, until September 9, its limiting height was not reached by the kite, but probably exceeded 1,000 m. By September 12 the upper limit fell again to 600 m. Above this nearly saturated stratum, an extremely dry wind was encountered, the recorded humidity (possible error of 10 per cent.) being in some cases only 5 per cent. to 10 per cent. These warm upper winds were of land origin, and showed very rapid diurnal changes of temperature. The report is well illustrated by means of vertical temperature gradient diagrams, as well as by weather maps.

WORK OF THE PHILIPPINE WEATHER BUREAU.

SOME idea of the amount of work now being done by the Philippine Weather Bureau may be gained from the fact that the *Annual Report* of the director for the year 1903, which has recently been mailed, embraces 1,128 pages, quarto size, of tabulated meteorological observations. With such a volume in hand, or rather on one's desk, for it is too heavy to hold, one who did not know what the Philippine Weather Service has done would be inclined to say, What a hopelessly extravagant expenditure of time and money to collect and publish these data! But the Manila Observatory, and the whole meteorological service, have made the most excellent use of their records. It would be well for meteorology if as good use had everywhere been made of the results of the daily weather observations.

CLOUDINESS AND ASTRONOMICAL OBSERVATORIES.

THE value of accurate records of cloudiness is emphasized by certain suggestions contained in a recent paper by Professor E. C. Pickering, on 'An International Southern Telescope' (*Proc. Amer. Philos. Soc.*, XLV., 1906, 44–53). If the earth be divided into cloudy and clear halves, nine tenths of the present observatories lie in the cloudy regions. It is

a striking fact that if the three extensive clear regions of the earth are considered, there are no large observatories located within them. The interior of northern Africa has no large observatory. The only large observatory in South Africa is in Cape Town, an exceptionally cloudy part of that region. In Australia, the clear interior is left unoccupied, while the two principal observatories are on the coast, at Sydney and Melbourne. The well-known Harvard Southern Observatory, at Arequipa, Peru, is handicapped by clouds in summer (November to March). There seems a possibility of excellent conditions in South Africa, but it is doubtful as yet whether the conditions would be better than at Arequipa.

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PALEONTOLOGICAL NOTES.

THE PENGUINS.

Dr. Wiman's and Dr. Ameghino's papers on fossil penguins are so important as to demand review, although it is some little time since they appeared. Dr. Carl Wiman deals with the bones of fossil penguins obtained at Seymour Island by the Swedish South Polar Expedition; Dr. Florentino Ameghino while nominally giving an enumeration of fossil penguins of Patagonia and Seymour Island gives descriptions and figures of all the species and also discusses their probable origin. Dr. Wiman describes as new five species, each of which is referred to a new genus, while Dr. Ameghino describes nine new genera and thirteen new species, and also replaces the nomen nudum *Apterodytes* by *Paleoapterodytes*. Dr. Wiman, who is very conservative, states that his specimens may represent more than the five species described since, owing to the conditions under which they were found, it has not been possible to correlate the bones. Adding to the nineteen genera and thirty-one species admitted by Ameghino, the seven additional genera and eighteen species given in Sharpe's hand list, we have a total of twenty-six genera and forty-nine species of penguins. None of the existing genera, comprising seventeen species, have as yet been found in a fossil state.

Dr. Wiman ascribes the formation from which his specimens came to the Eocene, but in a note states that Dr. Wilckens, basing his opinion on the marine invertebrates, considers them as Oligocene or Lower Miocene. This agrees pretty well with the views of Ameghino, who holds that Seymour Island is geologically a portion of Patagonia and the horizon of Wiman's specimens Miocene. The point of greatest interest is that both authors state that the earlier species of penguin, so far as shown by their limbs, and especially by the tarsi, are much more generalized than the living species and Wiman, in particular, says that his specimens show a much closer resemblance to the corresponding bones of carinates than do the same parts of modern penguins. The tarsi, it may be said, are comparatively longer in the fossil species than in recent forms and their component bones much less clearly indicated. This is exactly the reverse of what should be found, if the generally accepted theory that the tarsus of the penguin is a survival of the primitive free condition of the tarsal bones, is correct, and further discoveries may, of course, bring to light forms ancestral to the penguins in which the tarsal bones are free. Still it is to be remembered that in *Archæopteryx* the tarsals are fused and this is also the case with the known cretaceous birds in some of which the tarsus is highly specialized. The above facts agree with my own view that a large portion of the characters which have been held to place the penguins in a group apart from other Euornithes, are purely adaptive and while the adaptive features of the short broad tarsus may not at first be evident, it is very likely correlated with the habit of sitting with the tarsus on the ground when at rest. In walking, the tarsus is held upright as in any other bird. Right here, it may be well to say a word or two in regard to the tarsus of *Ceratosaurus*, which is referred to by Dr. Wiman, and to state that Dr. Baur was entirely correct in ascribing the union of the tarsals in this genus to pathological causes. The type of this genus is in the U. S. National Museum

and the bones of the tarsus were broken and healed during life, the accompanying exostosis soldering them together. It is most unfortunate that this wilful error should be perpetuated, but like Richardson's figure of the pouched rat, it will probably endure for generations to come.

The most generalized penguins are placed by Ameghino in the family *Cladornidæ* including but two species, *Cladornis pachypus* and *Cruschedula revolva*. The figure of this last is poor and from this alone it is not quite evident why it should be placed with the penguins at all. Wiman and Ameghino agree in considering that the penguins originated in the Southern Hemisphere and that they have always had much the same distribution as at present. Ameghino further believes they descended from species that inhabited the vicinity of fresh water. The known facts bear out the first conclusion, but in view of the little we know regarding the history of birds it will be best to accept it subject to further revision.

The above notes had just been sent in when Dr. Abel's paper from Centralblatt für Mineralogie * * * was received. In this Dr. Abel discusses the bones described by me in 1900 as the pelvis of Zeuglodon and concludes that they are really the coracoids of a gigantic bird which he names *Alabamornis gigantea*.

The paper seemed so clear and convincing that this conclusion was at once accepted and a brief review begun on that basis. As this proceeded it became evident, with my knowledge of the bones in question, that if they were the coracoids of a bird, that bird was extraordinary not say exceptional in many particulars. It has, therefore, seemed best to postpone the review of Dr. Abel's paper until later in order to better examine certain details and if possible, reexamine the bones themselves. This is not for the sake of mere argument as to whether the bones are those of a bird or beast but because, if they are from a bird, they are most important.

The bearing on this particular article lies in the fact that Dr. Abel finds the nearest resemblance to these bones in the coracoid of *Anthropornis*, described by Dr. Wiman, although the differences between the two are great.

F. A. LUCAS.

SCIENTIFIC NOTES AND NEWS.

DR. A. A. MICHELSON, professor of physics at Chicago, has been elected a foreign member of the Accademia dei Lincei, Rome.

DR. L. A. BAUER has been elected a corresponding member of the Göttingen Royal Academy of Sciences.

IN connection with the recent meeting of the British Medical Association in Toronto, McGill University, Montreal, will confer the degree of LL.D. *in absentia* on Sir Thomas Barlow, Sir William Broadbent, Professor Allbutt and Sir Victor Horsley.

THE Graefe medal of the German Ophthalmological Society has been awarded to Dr. Ewald Hering, professor of physiology at Leipzig.

DR. KUNO FISCHER has retired from the professorship of philosophy at Heidelberg.

DR. SIMON SCHWENDENER, professor of botany at Berlin, has celebrated the fiftieth anniversary of his doctorate.

Nature states that Mr. William Lutley Sclater has resigned the directorship of the South African Museum, Cape Town, which he has held for the last ten years, and has returned to England. He has accepted the post of director of the museum of Colorado College.

FROM the same journal we learn that Mr. Michael John Nicoll, who recently returned from accompanying the Earl of Crawford as naturalist during his winter voyage in the *Valhalla*, R.Y.S., round Africa, has accepted the post of assistant director of the Zoological Gardens at Giza, near Cairo, and has left England to take up the duties of his appointment.

DR. FRIDTJOF NANSEN, the Norwegian minister to Great Britain, has accepted the presidency of the Social and Political Education League in succession to Professor F. W. Maitland.

Dr. E. Grossmann, assistant in the Observatory of Kiel, has been made an observer for the Commission of International Geodesy under the Munich Academy of Sciences.

Mr. John Evershed, has been appointed assistant director of the Kodaikánal Observatory.

Dr. Kaunhowen has been appointed geologist in the Geological Bureau at Berlin.

Captain Lenfant, the French explorer, is about to leave on another expedition to West Africa in order to discover, if possible, a navigable waterway connecting Lake Chad with the coast of the Atlantic.

Professor A. Gruvel, formerly of Bordeaux, has been appointed to examine and report on the sea and river fisheries of the French possessions in West Africa.

Professor W. Kükenthal, of Breslau, will this winter make a zoological expedition to the West Indies under the auspices of the Berlin Academy of Sciences.

The committee of the Pettenkofer foundation at Munich has awarded its annual prize of 1,200 Marks to the late Dr. Fritz Schaudinn, for his researches on the protozoa. The prize will be given to his widow. A movement has been set on foot to raise a memorial fund to be applied for the benefit of Dr. Schaudinn's widow and children.

A portrait of Robert Bunsen by Herr Trübner, of Karlsruhe, is to be presented to the German Museum of Munich by the Grand Duke of Baden.

The portrait of Dr. A. J. Evans, F.R.S., to be painted by Sir W. B. Richmond, R.A., is to be placed in the Ashmolean Museum, Oxford, in commemoration of his services to archeology.

The Swedish Geographical Society is about to erect at Stockholm a monument in memory of Andrée and his companions Strindberg and Fraenkel.

William Buck Dwight, professor of geology at Vassar College since 1878, died on August 29 at Cottage City. He was born at Constantinople in 1833, the son of an American missionary, and graduated from Yale University and the Union Theological Seminary. Professor Dwight was a fellow of the American Association for the Advancement of Science and one of the original fellows of the Geological Society of America. He was the author of researches on Cambrian and Ordovician geology.

Dr. Alexander Bogdanow, professor of pathology at Odessa, has died at the age of fifty-two years.

Dr. Hans Jahn, associate professor of physical chemistry in the University of Berlin, died on August 7, at the age of fifty-three years.

The death is announced of M. Léon Adrien Prunier, professor of pharmacology at Paris, at the age of sixty-five years.

The late Professor Tarnowski, the Russian dermatologist, has bequeathed his estate for the establishment of a sanatorium for physicians.

It is reported from Yokohama, Japan, under date of August 27, that the magnetic survey yacht *Galilee,* which sailed from San Francisco about a year ago under the auspices of the department of terrestrial magnetism of the Carnegie Institution, was driven on the breakwater at Yokohama during a typhoon on August 24. It was considerably damaged, but has been refloated and docked for repairs. The crew and scientific men are safe.

At a conference of the International Geodetic Association to be held at Budapest on September 20, the principal topics considered will be the accurate surveying of mountain chains subject to earthquake, with a view to ascertaining whether these chains are stable or whether they rise and sink, and the taking of measures of gravity so as to throw light upon the distribution of masses in the interior of the earth and upon the rigidity of the earth's crust. The drawing up of preliminary reports on these two questions has been entrusted to M. Lallemand, director of the general survey in France, and Sir George Darwin.

The fifth biennial meeting of the International Commission for Scientific Aeronautics

will be held this year at Milan, from September 30 to October 7. A program for continuing the meteorological exploration of the atmosphere will be adopted, and it is expected that the president of the commission, Professor Hergesell, will state the results of soundings of the atmosphere, which he has just executed near Spitzbergen from the Prince of Monaco's yacht, and that Messrs. Teisserenc de Bort and Rotch will give an account of the second Franco-American expedition which they sent last winter to the tropical Atlantic for a similar purpose. This country will be represented at the meeting by Mr. A. Lawrence Rotch, director of Blue Hill Observatory, who is the American member of the commission.

WE learn from *Nature* that the Otago University Museum has been enriched by a valuable collection of eggs of New Zealand birds presented by Dr. Fulton, and also by the gift of a large series of ethnological objects from Mr. and Mrs. James Mills. The latter, which are chiefly weapons, are mostly Polynesian, and were collected some twenty-five years ago.

THE work of the State Geological Survey on the coal fields of Illinois is going rapidly forward. A large number of mines already have been visited, and careful samples taken for laboratory study, 160 such samples being now on hand. Director Bain recently visited the Livingston and La Salle County fields, preparatory to making careful surveys. J. A. Udden is now engaged in working out the faults near Peoria, which have been such a constant source of annoyance and expense to operators in that vicinity. T. E. Savage is making a detailed study of the Springfield mines. J. J. Rutledge has taken up an investigation of the coals of the East St. Louis-Belleville area and F. W. De Wolf is about to begin work in Saline and Gallatin counties. His work, as also that of David White, who is making collections of fossil plants throughout the field, is carried on by the U. S. Geological Survey in cooperation with that of the state. Topographic surveys preparatory to next season's work are being carried on near Harrisburg, Marion, Herrin, Murphysboro, Trenton, Edwardsville, Alton and Talhula. A preliminary report upon the composition and character of Illinois coals is in press.

IN his report on the general progress at the British Museum (Natural History), Dr. E. Ray Lankester, director and acting keeper of zoology, states, according to an abstract in the London *Times*, that in 1905, for the first time since the opening of the Natural History Museum, the number of visits paid to the galleries by the public in any one year exceeded half a million, the total number recorded being 566,313, an increase of 95,756 over the total in 1904 and of nearly 80,000 over that of any previous year. The number of visits recorded as having been made on Sunday afternoons was 70,084, as against 60,909 in 1904. The average daily attendance for all open days during the year was 1,560.09; for week-days only, 1,600.73; and for Sunday afternoons, 1,322.34. The total number of visits paid during the year to the department of zoology by students and other persons requiring assistance and information amounted to 11,811, as compared with 11,824 in 1904 and 11,627 in 1903.

AN exhibition of apparatus useful in the teaching of regional geography was held in the Outlook Tower, Edinburgh, from July 6 to 14. The exhibition had special reference to the region immediately round Edinburgh.

IT is said that Staten Island has been practically freed from mosquitoes by the expenditure of an appropriation of $17,000. An area of salt marshes equal to twenty square miles has been drained. It is estimated that 230 miles of ditches, ten inches wide by two feet deep, have been dug this summer. Literature giving directions for the care of private premises directed toward the prevention of the propagation of mosquitoes has been distributed.

THE fourteenth International Congress of Hygiene and Demography will be held in Berlin from September 23 to 29, 1907. The work of the congress will be distributed among eight sections, as follows: (1) Hygienic Microbiology and Parasitology; (2) Hygiene of

Nutrition and Hygienic Physiology; (3) Hygiene of Childhood and School Life; (4) Industrial Hygiene; (5) The Prevention of Infectious Diseases and the Cure of Patients suffering therefrom; (6) *a*, Hygiene of the Dwelling and the Community; *b*, Hygiene of Traffic; (7) Military, Colonial and Marine Hygiene; (8) Demography. An exhibition is to be held in connection with the congress.

The Academy of Sciences of Berlin has received the preliminary report of the mission which went to Abyssinia last spring to explore the ruins of the ancient city of Aksum.

It is said that valuable documents relating to Volta were destroyed in the fire at the Milan International Exposition, which caused a loss of some $2,000,000.

Foreign journals announce that Dr. W. J. Goodhue, medical superintendent of the Molokai Leper Settlement, has, after several years of research, succeeded in demonstrating the bacillus of leprosy in the mosquito (*Culex pungens*) and the common bed-bug (*Cimex lectularius*).

The British home secretary has appointed a departmental committee to inquire and report what diseases and injuries, other than injuries by accident, are due to industrial occupations, are distinguishable as such, and can properly be added to the diseases enumerated in the third schedule of the Workmen's Compensation Bill, 1906, so as to entitle to compensation persons who may be affected thereby. The chairman of the committee is Mr. Herbert Samuel, M.P., parliamentary under-secretary of state for the Home Department; and the members are Professor Clifford Allbutt, F.R.S., regius professor of physics at Cambridge University; Mr. H. H. Cunynghame, C.B., assistant under-secretary of state, Home Office; and Dr. T. M. Legge, medical inspector of factories.

UNIVERSITY AND EDUCATIONAL NEWS.

By the will of the late Theodore Kearney, of Freno, his entire estate, amounting to about $1,000,000, is bequeathed to the department of agriculture of the University of California. It is said that the will will be contested by a cousin, under the provisions of the California law that not more than one third of an estate shall be bequeathed to charity when there are legal heirs. The will takes cognizance of this section of the code, and appoints four prominent men to inherit any portion of his estate which can not legally go to the university. It is also claimed that the State University is not a charitable institution, but part of the state government.

According to *The Athenæum* the number of matriculated students at the German universities during the summer term is 44,942, an increase of over 3,000 on last year. Of these 6,569 are at Berlin, 5,734 at Munich, 4,147 at Leipsic, 3,275 at Bonn, 2,350 at Freiburg, 2,128 at Halle, 1,925 at Göttingen, 1,922 at Heidelberg, and 1,362 at Jena, while the rest are distributed among various universities. There are 12,413 students of law; 10,752 are studying philosophy, philology or history, 6,584 medicine, and 6,212 mathematics or natural science. The number of students has nearly trebled during the last thirty years, the returns for 1876 showing that in that year the entries amounted only to 16,812.

Mr. Leroy Abrams, of the Smithsonian Institution, a former instructor in Stanford University, has been made assistant professor of systematic botany at Stanford.

M. Carlo Bourlet has been appointed professor of descriptive geometry in the Paris National Conservatory of Arts.

Dr. Möller has been appointed director of the Forest School at Eberswalde.

Dr. David von Haussmann, of Berlin, has been called to the chair of pathology at Marburg.

Dr. Karl Hintze, professor of mineralogy at Breslau, has been called to Bonn.

Dr. Arnold Sommerfeld, professor in the Technical Institute at Aachen, has accepted the chair of theoretical physics at Munich.

Professor Röntgen, of Munich, having declined the offer of the chair of physics at Berlin University in succession to the late Professor Paul Drude, the direction of the physical institute has been temporarily placed in the hands of Professor Nernst.